Emerging Evidence on COVID-19

Summary of Infection Prevention and Control (IPAC) & Healthcare Response Intervention Research

Introduction:
Research and emergency preparedness activities in healthcare settings, expert guidance on the clinical management of suspected and confirmed cases of COVID-19, as well as surveys of healthcare workers are important to keep appraised. This work can provide guidance on working in healthcare settings as the COVID-19 pandemic is evolving. This report briefly summarizes the COVID-19 literature on IPAC and Healthcare up to March 17, 2020.

Key Points

- SARS-CoV 2 virus can remain viable up to 4hrs following aerosolization, and up to 4hrs on copper, 24hrs on cardboard, and 2-3 days on plastic and steel surfaces.
- Data from two Chinese cities support early implementation of control measures by contrasting the burden of COVID-19 patients on each healthcare system.
- Patient screening and triage at admission, suspension of non-essential services were widely implemented in hospital and healthcare settings across China during COVID-19 response.
- The emerging evidence on healthcare workers continue to highlight the need for psychological support for frontline workers responding to COVID-19.

Overview:

This document provides a synopsis of 66 publications on COVID-19 that focus on Infection Prevention and Control (IPAC) and Healthcare Response. Published literature has been identified via a daily scan of COVID-19 scientific publications and includes research up to March 17, 2020. Healthcare response captures evidence on healthcare based interventions and clinical practice guidance put forth in various healthcare settings during COVID-19 response. Infection, Prevention, and Control (IPAC) captures evidence and recommendations intended to reduce
SARS-CoV-2 transmission risk between patients and healthcare workers (i.e. nosocomial transmission).

Relevant primary evidence, expert guidance on the clinical management of suspected and confirmed cases of COVID-19, as well as surveys of healthcare workers are summarized.

The evidence summarized in this report can inform and support the development of emergency preparedness and COVID-19 response practices in Canadian healthcare settings.

**Patient Assessment and Screening for COVID-19**

A number of articles outline patient risk scoring processes and clinical triage rules developed and implemented at various hospitals in China in response to COVID-19.\(^{(1-6)}\)

- Patient assessments include screening of patients for respiratory symptoms and identification of epidemiological links based on travel to endemic regions or contact with other cases of COVID-19 in the previous 14 days, at initial presentation. \(^{(1-5, 7)}\)
- Chest CT scans and laboratory confirmation via SARS-CoV-2 nucleic acid amplification testing of respiratory tract specimens are recommend for patients suspected to be at risk of infection through patient screening. \(^{(1-6)}\)
- Overall, the reported patient assessment criteria are consistent with Center for Disease Control's interim guide for persons under investigation in the US.
- Zhang and colleagues reviewed clinical profiles of patients presenting at fever clinics in Wuhan, China. The authors recommend C-reactive protein levels and impaired immunity (lymphopenia) be considered during patient screening and triage for COVID-19.\(^{(2)}\)
- Lu and colleagues reviewed clinical data and developed a short-term mortality risk score for COVID-19 cases based age and C-reactive protein levels. Patients classified as Grade 3 are at highest of short-term mortality following COVID-19 infection; Grade 3 (age ≥ 60 years and CRP ≥ 34 mg/L); Grade 2 (age ≥ 60 years and CRP < 34 mg/L OR age < 60 years and CRP ≥ 34 mg/L); Grade 1 (age < 60 years and CRP < 34 mg/L).\(^{(3)}\)
- Schwartz and colleagues adapt Traffic Control Bundling (TCB), previously implemented in Taiwanese hospitals to reduce infection transmission risk to healthcare workers, to COVID-19.\(^{(7)}\) According to this process screening and triage of patients take place outdoors and patients who test positive, demonstrate atypical symptoms or have inconclusive results are directed to isolation or quarantine wards respectively. These patients move within the healthcare facilities via designated routes AND healthcare workers don necessary PPE prior to crossing from the clean barrier to isolation/quarantine wards or routes.\(^{(7)}\)
- A triaging and testing process for rapid testing of suspect COVID-19 cases implemented in a hospital in Changsha, China facilitated rapid screening of 247 patients.\(^{(8)}\) The process suggests the use of two distinct triage areas for symptomatic patients. \(^{(8)}\) Section A for patients with epidemiological links and Section B for patients without such exposure links. In section A, mildly symptomatic patients are attended to by a physician

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\[^{(1-6)}\] 1-6: Various references cited in the text.

\[^{(7)}\] 7: Reference to the Traffic Control Bundling process.

\[^{(8)}\] 8: Reference to the rapid testing process in Changsha, China.
(meds prescribed) and asked to self quarantine at home, while others tested by RT-PCR. In section B, patients are tested if COVID-19 infection is suspected through chest CT scan, otherwise patients are attended to by a physician (meds prescribed) and asked to self quarantine at home or transferred to the appropriate clinical department when/if tests were negative. Telephone follow-up was implemented for patients in self-quarantine and transferred to designated COVID-19 hospitals if symptoms progressed.

- Specific guidance on the assessment and management of COVID-19 infections among children\(^\text{[15, 9]}\) and pregnant women\(^\text{[4]}\) appear in the literature.

**Clinical Management of Patients with Suspect or Confirmed COVID-19 Infections**

Thirty four guidance documents, commentaries, and “Letters to the Editor” provide recommendations on the clinical management of patients with COVID-19. Reports identified to date are grouped by hospital department or setting in Table 1. COVID-19 guidance from North America and Europe are starting to appear within emerging published literature, previously the majority of such documents were on response experiences in China and Hong Kong.

- Infection Prevention and Control (IPAC) strategies to prevent nosocomial transmission of SARS-CoV-2 to healthcare workers and other patients in healthcare settings (i.e. nosocomial transmission) are emphasized across documents.

- Two guidance documents provide insights regarding the clinical management of COVID-19 within the Canadian health system.\(^\text{[10, 11]}\)
  - Wax and Christian review practical recommendations on patient screening, personal protective equipment including powered air purifying respirators (PAPR), and critical care unit operations planning in the Canadian context. The recommendations apply experiences and lessons learned through 2003 SARS response in Toronto, Canada.\(^\text{[10]}\)
  - Marchand-Sénécal and colleagues report on the diagnosis and management of the first case of COVID-19 in Canada. The patient was admitted to an Airborne Infection Isolation Room (AIIR) at the hospital, discharged following the resolution of fever and successfully recovered. No nosocomial transmission of the infection occurred during the management and care of this patient.\(^\text{[11]}\)

- The March issue of Mortality and Morbidity Weekly Report (MMWR) includes a report that provides details on the active monitoring and isolation of 12 travel related COVID-19 cases and their close contacts (n=445) in the US. Three secondary cases of COVID-19 are reported to have occurred among close contacts of the initial 12 cases.\(^\text{[12]}\) These cases and the monitoring process was previously described by Patel and colleagues.\(^\text{[13]}\)

- Overarching IPAC strategies identified across healthcare guidance documents include:
Establishing training programs for healthcare workers that focus on COVID-19 infection prevention (e.g. hand hygiene, respiratory etiquette, monitoring of symptoms, effective personal protection equipment donning and duffing).

Minimizing the number of non-essential patient visits during the COVID-19 epidemic, when possible implementing on-line medical consultations.

Active screening of patients for suspect and confirmed COVID-19 case identification.

Restricting the number of healthcare workers who care for the suspect or confirmed COVID-19 patient, and monitoring healthcare workers for respiratory symptoms.

Postponing invasive non-critical and/or elective procedures among suspect and confirmed cases.

If procedures that increase nosocomial infection transmission risk (e.g. intubation, ventilation, surgery) are necessary for suspect or confirmed COVID-19 patients. These procedures are to be performed in consultation/collaboration with multidisciplinary teams, in isolation within negative pressure rooms/wards/designated hospitals, with dedicated equipment and appropriate healthcare worker personal protective equipment (i.e. airborne/droplet/contact precautions).

Following the procedures, effective room disinfection (e.g. disinfecting solution containing 1 000 mg / L of available chlorine), environmental cleaning, equipment reprocessing, and waste management process are to be followed (e.g. special infection marking on medical waste and used medical instruments).

**HEALTHCARE WORKER PERSONAL PROTECTIVE EQUIPMENT AND SARS-CoV-2 TRANSMISSION**

Evidence does not suggest there is variability in SARS-CoV-2 infection transmission risk to healthcare workers based on N95 respirator or surgical mask use\(^{(14)}\). This evidence is consistent with transmission risk to healthcare workers from other viral respiratory infections like Influenza\(^{(15)}\).

- A contact tracing exercise of 41 healthcare workers (85% in surgical masks and 15% in N95 respirators) who cared for a patient infected with COVID-19 (prior to confirmation of infection) requiring intubation for the management of severe pneumonia, found there was no difference in infection transmission based on surgical masks vs. N95 respirators. All healthcare workers were found to be free of virus and symptoms 14 days following this exposure\(^{(14)}\).

- A study comparing N95 respirators to NOT wearing masks in a Chinese hospital during the initial epidemic phase of COVID-19 did find N95 to be effective in preventing SARS-CoV-2 transmission to healthcare workers. Infection rate among healthcare workers NOT wearing any personal protective masks is reported to be 4.6% (n=10/213).\(^{(16)}\)
**Management of Suspect and Confirmed COVID-19 Cases When Isolation Rooms Are Limited**

The rise in COVID-19 infections can lead to increased patient care burden and a scarcity of limited single patient isolation rooms in healthcare settings. During these circumstances, alternative isolation practices may be required to reduce infection transmission risk. A report from UK suggests the use of facemasks among presenting patients who are to be seated a minimum of 2 meters from one another. A report from Honk Kong suggests caring for COVID-19 patients in wards with 1 meter spacing between patients, when Airborne Infection Isolations Rooms are unavailable.

**Healthcare System Preparedness and Response to COVID-19**

Various commentaries propose similar guidance on how healthcare systems should prepare and respond to COVID-19. These strategies appear based on past lessons learned and expert opinions. Commonly cited strategies focus on the development of multidisciplinary preparedness/response teams, coordination of healthcare resources (e.g. designated hospitals for COVID-19 patients, personal protective equipment for healthcare workers) and effective communication and regional coalition on outbreak management across hospitals, local public health and government authorities.

Individual strategies are not detailed in this document as they focus on varied healthcare delivery systems in different regions.

**SARS-CoV-2 Contamination and Viability on Healthcare Surfaces**

Multiple studies have specifically investigated the viability of SARS-CoV-2 on various surfaces.

- Multiple studies on aerosol deposits confirm viable SARS-CoV-2 virus particles to be present in aerosols up to 4hrs post aerosolization, and aerosols play a key role in the contamination of healthcare surfaces.
- A study investigating the extent of healthcare surface contamination of SARS-CoV-2 at a Wuhan hospital found ICU and isolation wards treating COVID-19 patients to be the most contaminated. The objects most contaminated were self-service printers, keyboards, healthcare worker gloves, and hand sanitizer dispensers. The study suggests these objects can readily act as fomites in the chain of infection transmission.
- Van Doremalen and colleagues confirm SARS-CoV-2 virus viability to be similar to other human corona viruses, and viable on copper surfaces for 4hrs, cardboard for 24hrs, and 2-3 days on plastic and steel surfaces.
- A study investigating SARS-CoV-2 contamination of healthcare surfaces during the treatment of COVID-19 patients in Airborne Infection Isolation Rooms (AIIR) found air-outlet fans in isolation rooms were contaminated. This evidence
suggests small virus-laden droplets can displace in hospital ventilation systems (if AIIR airflow is not to the outside).\textsuperscript{(24)}

- It is important to note all tested environmental surfaces were found to be negative for SARS-CoV-2 post cleaning and disinfection with sodium dichloroisocyanurate\textsuperscript{(24)}

\textbf{SARS-CoV-2 Disinfection}

- Chlorine-containing disinfectants (1000 mg/L and/or 500 mg/L), 75% ethanol, hydrogen peroxide are frequently recommended chemical disinfectants for SARS-CoV-2. Specific disinfection details are included in Table 1
- In Canada, the patient room was terminally cleaned using 0.5% hydrogen peroxide, twice after the index COVID-19 patient was discharged from the Toronto hospital.\textsuperscript{(11)}

\textbf{Healthcare Workers (HCW) Responding to COVID-19}

Multiple cross-sectional surveys have investigated knowledge, anxiety, and emotional responses of healthcare workers responding to the COVID-19 epidemic in China\textsuperscript{(26-32)}. A global survey of healthcare worker awareness and preparedness on COVID-19 is underway, the study protocol is available [here](#).

This type of research can support our understanding of mental health stressors and coping mechanisms of healthcare workers who are called to work long hours under strained resources, and accept infection transmission risks to themselves during an outbreak response.

- A survey of an international sample of healthcare workers report 61% of responding healthcare workers obtained the information on COVID-19 from social media sources.
- A national sample of primary care physicians (n=1751) across China were found to be knowledgeable about COVID-19 and stated to have provided information about the infection to local communities through on-line consultations.\textsuperscript{(26)}
- Surveys on physiological and emotional impacts, found anxiety, psychological distress, and fear to be prevalent among healthcare workers, and self-efficacy to be inversely correlated with feelings of isolation and loneliness.\textsuperscript{(27-29, 31, 32)} These feeling were more profound among front-line staff reporting direct contact with COVID-19 patients.\textsuperscript{(27-29, 31)}
- Main concerns among healthcare workers focused on possible COVID-19 infection risk to colleagues and family members.\textsuperscript{(27)}
IMPACT OF CONTROL MEASURES ON HEALTHCARE BURDEN

A commentary comparing and contrasting healthcare data extracted from the two cities of Wuhan and Guangzhou, supports the effects of early COVID-19 control measures on healthcare burden and rates per patient days are provided. In Wuhan, during the peak of the epidemic, 19,425 patients (24.5 per 10,000 adults) were hospitalized, 9,689 (12.2 per 10,000 adults) were considered to be in serious condition, and 2,087 patients (2.6 per 10,000 adults) needed critical care per day. Whereas in Guangzhou, where control measures such as social distancing, contact tracing, and quarantine protocols were rapidly implement to control the early importation of cases. In this city, the case burden was substantially less at 15 patients in critical condition and 38 patients in serious condition during the peak period.
Table 1: Clinical Management of Patients with Suspect or Confirmed COVID-19 Infections

<table>
<thead>
<tr>
<th>Reference</th>
<th>Report Details</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Surgery Procedures and Settings</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Tao et al., 2020(34) | Recommendations for general surgery clinical practice in novel coronavirus pneumonia situation | - Elective surgeries are to be postponed during the pandemic  
- Multidisciplinary teams should be consulted to determine which diagnosis, treatment/surgical plans should be followed to minimize infection transmission  
- Specific IPAC recommendations for surgical settings, general surgery outpatient settings, pre-operative and post-operative care are listed |
| Ti, Ang, Foong & Ng., 2020(35) | What we do when a COVID-19 patient needs an operation: operating room (OR) preparation and guidance  
Letter to the editor on the surgical management of COVID-19 cases in Singapore – prefaced as a response to the Wax, 2020 article(7) | - Based on OR management of COVID-19 cases in Singapore  
- OR with negative pressure and separate access used  
- OR staff done full PPE have designated roles and responsibilities that are assigned prior to the procedure  
- Dedicated transport ventilator used to transfer patients between ICU and OR, staff wear PPE and powered air-purifying respirator (PAPR) during patient transfers  
- Personnel exiting the OR discard used gowns and gloves in the anteroom and perform hand hygiene before leaving the anteroom; PAPR is removed outside the anteroom.  
- Patients who do not require ICU care postoperatively are fully recovered in the OR itself.  
- 1 hr intervals planned between OR use of cases for full cleaning and disinfection |
| **Critical Care and Emergency Medicine Procedures and Settings** | | |
| Kim, Ko, & Kim, 2020 (36) | Recommendations for Anesthesia in Patients Suspected of Coronavirus 2019-nCoV Infection | - Clinical guidance on the medical management of anesthesiology patients  
- Emphasis on PPE and patient screening |
<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Commentary</th>
</tr>
</thead>
</table>
| Murthy, Gomersall, & Fowler, 2020(37) | Care for Critically Ill Patients With COVID-19 Commentary | - Provides clinical guidance on the medical management of critically ill cases of COVID-19, to reduce the need for mechanical ventilators  
- Guidance based on the usual management of viral pneumonia with respiratory failure with additional precautions to reduce risk of infection transmission  
- **Specific to COVID-19 antiviral or immunomodulatory therapies are not yet proven to be effective for treatment of COVID-19, and patients should be asked to participate in clinical trials for supportive or targeted therapies** |
- ECMO is recommended for patients with Acute Respiratory Distress Syndrome (ARDS) caused by severe neocoronary pneumonia, before multiple organ damage occurs after no improvement is observed with standard Acute respiratory distress syndrome Tx, IF NO contraindications are identified  
- Contraindication for ECMO are provided |
| Cabrini, Landoni, & Zangrillo, 2020(39) | Minimise nosocomial spread of 2019-nCoV when treating *acute respiratory failure* Commentary | - Recommends the use of helmets connected to ventilator without air dispersion through a spring-valve for patient during non-invasive ventilation procedures to reduce COVID-19 transmission risk from droplets  
- Adoption of helmets recommended over face masks as a non-invasive ventilation interface |
| Wax & Christian, 2020(10) | Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients, (Canadian Context A Canadian Publication with the Canadian Healthcare context in mind Frequent reference to Canada’s SARS experience | - Screening of patients at consultation to identify suspect cases that meet clinical criteria and report epidemiological linkage  
- Air borne, droplet, and contact precautions applied to patients in respiratory distress or febrile respiratory symptoms, for whom epidemiological linkage information can not be obtained  
- ER and ICU departments should have a “ready bed” with airborne isolation capacity to house and manage a suspect case  
- Powered air purifying respirators (PAPR) over N95 respirators are stated to be reasonable for high-risk resuscitation scenarios  
- Considerations for decisions on PAPR use are provided |
<table>
<thead>
<tr>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Aerosol generating procedures to be preformed in negative pressure rooms</td>
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<td>- Operating rooms should be converted from positive to negative pressure rooms with airflow management, otherwise operative procedures may be done in negative pressure rooms/wards</td>
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<td>- IV anesthesia is recommended</td>
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<tr>
<td>- Suggest the adoption of protected code blue to distinguish usual resuscitation from suspect COVID-19 cases</td>
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<table>
<thead>
<tr>
<th>Zuo et al., 2020(40)</th>
<th>Expert Recommendations for <strong>Tracheal Intubation in Critically ill Patients</strong> with Novel Coronavirus Disease 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>- High-risk aerosol-producing may put the anesthesiologists at high risk of nosocomial infection transmission</td>
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<td>- Endotracheal intubation should be preformed on severe patients after standard O₂ therapy</td>
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<td>- During airway management, enhanced droplet/airborne PPE should be applied to the healthcare providers, and procedures preformed in an airborne isolation room; Air way assessment should be preformed</td>
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<td>- Awake intubation should be avoided in patients with good airways and modified rapid sequence induction is recommended with sufficient muscle relaxant, for patients with difficult airways</td>
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<tr>
<td>- Good preparation of airway devices and detailed intubation plans are recommended</td>
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<thead>
<tr>
<th>Qing et al., 2020(41)</th>
<th><strong>Emergency management</strong>, prevention and control of novel coronavirus pneumonia in specialized branches of hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Setting up a multidisciplinary group focusing on IPAC, staff education and training on IPAC, organization and coordination of personnel and material for outbreak activities, screening of patients for COVID-19 risk, restricted access implemented in the hospital are discussed</td>
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<table>
<thead>
<tr>
<th>Cardiology Procedures and Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si, Sun, Zhong, Yue, &amp; Fu., 2020(42)</td>
</tr>
<tr>
<td>- Pre-examination with a focus on clinical symptoms, epidemiological linkages, and CT scans to identify suspect cases</td>
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<tr>
<td>Suspect COVI-19 case management</td>
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<tr>
<td>- Transport to isolation rooms/wards or designated hospitals for patient management including anti-pneumonia virus treatment and anti-shock treatment</td>
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</tbody>
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### Recommendations for patients with aortic emergencies
- Multidisciplinary development of a surgical plan, including the assessment of risks vs. benefits of emergency surgery in patients with unstable vital signs
- Interventional surgery is recommended over traditional surgery to reduce infection transmission risk
- Robust post-operative monitoring and isolation

### Respirology Procedures and Settings

<table>
<thead>
<tr>
<th>Chronic obstructive pulmonary disease group of Chinese Thoracic &amp; Chronic obstructive pulmonary disease committee of Chinese Association of Chest, 2020 (43)</th>
<th>Medical Management and Prevention Instruction of Chronic Obstructive Pulmonary Disease (COPD) During the Coronavirus Disease 2019 Epidemic</th>
</tr>
</thead>
</table>
| - Recommendations on the medical management of COPD in China  
- Patients with COPD are considered at increased mortality and morbidity risk from COVID-19 infections |

| Respiratory care committee of Chinese Thoracic Society, 2020(44) | Expert Consensus on Preventing Nosocomial Transmission During Respiratory Care for Critically Ill Patients Infected by 2019 Novel Coronavirus Pneumonia  
Treatment guidance for COVID-19 pneumonia patients |
|---|---|
| - Outlines IPAC practices to reduce nosocomial transmission during intubation, manual ventilation by resuscitator, non-invasive ventilation, high-flow nasal cannula, bronchoscopy examination, suction, and patient transportation  
- Airborne precautions recommended for healthcare workers  
- Patient isolation, patient masking during high risk procedures and examinations, filters on ventilator outlets, resuscitators, and masks, use of sedation and paralytics during intubation are recommended |

<table>
<thead>
<tr>
<th>Li et al., 2020(45)</th>
<th>Preliminary Recommendations for Lung Surgery during SARS-CoV-2 Novel Coronavirus Pneumonia Epidemic Period</th>
</tr>
</thead>
</table>
| - Care and Management of patients diagnosed with lung lesions during the pandemic  
- Elective surgery (i.e. can be observed for 3 months) are to be postponed until after the epidemic  
- Bronchoscopy are NOT to be performed during the epidemic  
- Limited-term surgery should only be performed after COVID-19 infection has been excluded in the patient.  
- Exclusion of COVID-19 should happen by isolation and observation of surgical patients 2 weeks prior to the surgery |
| Interventional Respiratory Medicine Group of Chinese Thoracic Society, 2020(46) | Expert consensus for **bronchoscopy** during the clinical care of patients with 2019-nCoV | - Bronchoscopy is not recommended for routine diagnosis, or specimen collection for COVID-19 cases  
- Bronchoscopy should be suspended/postponed for suspect asymptomatic COVID-19 cases for 2 weeks to monitor symptom onset, or until 2 negative tests are obtained  
- Airborne and contact precautions (e.g. protective glasses or face shields, N95) applied and the procedure done in isolation in a negative pressure room for confirmed COVID-19 cases (but not recommended)  
- Use single use medical equipment where possible |
|---|---|---|
| Pan et al., 2020(47) | **Non-invasive Respiratory Support** for New Coronavirus Pneumonia: Stop It  
Based on clinical evidence that treatment of COVID-19 pneumonia, appears to lead to an overuse of non-invasive respiratory support treatment that causes tracheal intubation delay and affects patient prognosis | - Outlines indications and contraindications for the use of non-invasive ventilation, timely termination of non-invasive ventilation, and invasive ventilation that clinicians should review during treatment of ARDS (acute respiratory distress syndrome)  
- Discusses the advantages of non-invasive ventilation  
- Noted non-invasive ventilation may increase COVID-19 lung injury, hypoxemia and alveolar collapse, pulmonary edema, risk of pulmonary fibrosis.  
- Early identification of risk factors for failure of non-invasive ventilation treatment to avoid delays in intubation are discussed |
| Cai et al., 2020(48) | Analysis of **Bronchoscope Guided Tracheal Intubation** in 12 Cases With COVID-19 Under the Personal Protective Equipment With Positive Pressure Protective Hood | - Findings based on a retrospective study of 12 patients with COVID-19 requiring endotracheal intubation in ICU, all patients were intubated without complication.  
- Healthcare workers were protected with PPE and positive pressure protective hood.  
- All healthcare workers tested negative for COVI-19 and presented no symptoms 14 days following patient exposure. |
<p>| Gastroenterology Care Procedures and Settings | Discussion on the diagnosis and treatment of <strong>hepatobiliary malignancies</strong> during the outbreak of novel coronavirus pneumonia in Chinese | - Individualized plans based on clinical needs of the patient should be adopted during the epidemic for the treatment of hepatobiliary malignancies |</p>
<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ma, Hu, &amp; Tian., 2020(50)</td>
<td>Surgical treatment strategy for <strong>digestive system malignancies</strong> during the outbreak of novel coronavirus pneumonia</td>
<td>- Provides clinical management strategies than can be implemented for the duration of the epidemic when high risk procedures are postponed&lt;br&gt;- The diagnosis and treatment of tumor patients during the epidemic face many challenges: (1) patients immunocompromised status and increased mortality due to COVID19 infection, 2) admission delays leading to treatment delays, 3) anxiety and psychological pressure on patients and families.&lt;br&gt;- Early digestive system malignancies (e.g. gastric and colorectal cancer) should delay treatment until after the epidemic&lt;br&gt;- Patients need to be screened to exclude COVID-19 before emergency treatment&lt;br&gt;- The establishment of online communication channels to minimize the adverse effects of the epidemic on treatment.</td>
</tr>
<tr>
<td>Gou et al., 2020(51)</td>
<td>Treatment of <strong>pancreatic diseases</strong> and prevention of infection during outbreak of 2019 coronavirus disease</td>
<td>- Clinical data from 4 nosocomial cases of COVID-19 at the pancreatic surgery unit, of a main hospital in Wuhan presented&lt;br&gt;- Outlines IPAC strategies implemented (e.g. patient admission screening, admission of patients into single patient rooms, screening and limiting patient visitors, use of droplet precautions by medical personnel, ward disinfection (i.e UV sterilization, ward and surgical room floors, and high-touch surfaces cleaned with chorine (1000 mg/L) disinfectant), sterilization of reusable medical equipment with 75% ethanol, tagged disposal of suspect and confirmed case linens).&lt;br&gt;- High risk procedures such as central venipuncture catheterization, percutaneous thoracic or abdominal puncture drainage, and percutaneous retroperitoneal puncture drainage, percutaneous hepatic duct drainage, endoscopic retrograde cholangiopancreatography, surgery - should be preformed under airborne precautions&lt;br&gt;- Also states no invasive surgical procedures took place during the epidemic period</td>
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<tr>
<td>Reference</td>
<td>Title</td>
<td>Key Points</td>
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| Chen & Peng., 2020(52) | Treatment strategy for **gastrointestinal tumor management and surgery** under the outbreak of novel coronavirus pneumonia in China | - Screening of patients at consultation  
- RT-PCR and chest CT on patients with fever to rule out COVID-19 infections and novel coronavirus pneumonia  
- Surgical procedures reduced to minimize infection transmission (interventions for benign tumors postponed) and all invasive interventions performed in isolation, appropriate PPE for HCW (droplet precautions)  
- Surgical interventions replaced by multidisciplinary therapy and non-surgical anti-tumor therapy  
- Emergency operations performed for patients with acute uncontrolled bleeding, obstruction or after other alternative treatment measures fail |
| Yu, Lou, & Zhang., 2020(53) | Several suggestions for **operation for colorectal cancer** under the outbreak of Corona Virus disease 19 in China | - Laparoscopy-assisted radical surgery is recommended during the COVID-19 epidemic  
- Aerosols to be managed during the procedure  
- Additional details on various surgical procedures and applied IPAC precautions are detailed. |
| **Diagnostic Imaging and Radiology/Ultrasound Procedures and Settings** | | The following strategies are discussed in depth by various radiology experts  
- Coordination of COVID-19 response and preparation among radiology and other hospital departments  
- Screening patients and isolation of patients suspected of infection  
- Centralize PPE supplies and training for staff  
- Suspect and confirmed COVID-19 patients undergoing medical imaging placed under droplet precautions, through cleaning and decontamination of medical imaging equipment  
- Use of mobile imaging when possible  
Advocates for COVID-19 confirmatory testing via RT-PCR instead of chest CT due high diagnostic sensitivity being associated with the former |
<p>| Mossa-Basha et al., 2020(54) | Radiology Department Preparedness for COVID-19: Radiology Scientific Expert Panel Discusses steps taken by four different radiology departments in the US on responding to COVID-19 | |</p>
<table>
<thead>
<tr>
<th>Otolaryngology Care Procedures and Settings</th>
<th>Xu, Lai, &amp; Liu, 2020(56)</th>
<th>Suggestions for prevention of 2019 novel coronavirus infection in otolaryngology head and neck surgery medical staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>- N95 or N99 respirators and contact precaution, face shields and goggles are suggested PPE for healthcare workers in ENT surgery clinic settings</td>
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<tr>
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<td>- PPE should be applied based on clinical features of fever, epidemiological links, suspect or confirmed case status, and examination/procedure to be done</td>
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<td>- In areas with severe outbreaks, given that ENT surgeons are at high risk, the number of routine outpatient and ward work for non-emergency cases should be reduced</td>
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<td>- In areas with severe epidemics, outpatient medical staff should adopt secondary or tertiary protection, and surgical staff recommends tertiary protection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Burn and Wound Care Procedures and Settings</th>
<th>Li, Liu, Chen, &amp; Liao, 2020(57)</th>
<th>Management Strategy of Novel Coronavirus Pneumonia in Burn and Wound Care Ward</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>- Establishing a knowledge and training program for healthcare workers focused on COVID-19 infection and management</td>
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<td></td>
<td></td>
<td>- Developing an emergency epidemic plan focusing on ward layout, environmental cleaning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dermatology Care Procedures and Settings</th>
<th>Tao et al., 2020(58)</th>
<th>Emergency management for preventing and controlling nosocomial infection of 2019 novel coronavirus: implications for the dermatology department</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>- Pre-examination and triage of outpatients with skin lesions at hospital entrance and entry into dermatology department during the COVID-19 epidemic</td>
</tr>
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<td></td>
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<td>- Online consultation of non-emergency patients to reduce patient visit burden, and diagnosis of skin conditions via photographs for confirmed cases of COVID-19 in isolation</td>
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<tr>
<td></td>
<td></td>
<td>- Prompt emergency management of inpatients with COVID-19 symptoms in the dermatology department, and have daily discussions about the progression of suspected cases</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ophthalmology Care Procedures and Settings</th>
<th>Zhang, Xie, Xu, &amp; Cao., 2020(59)</th>
<th>Suggestions for disinfection of ophthalmic examination equipment and protection of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>- Screen patients for clinical symptoms of fever and epidemiological links</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Maintain air circulation in consultation room, advise patients to wear medical masks in waiting area</td>
</tr>
<tr>
<td>ophthalmologist against 2019 novel coronavirus infection</td>
<td><strong>ophthalmology</strong> settings as COVID-19 may cause conjunctivitis</td>
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<td>--------------------------------------------------------</td>
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<tr>
<td>Increased risk in Ophthalmology</td>
<td>When in contact with patients medical personnel should wear personal protective equipment (e.g. surgical masks, gloves and goggles)</td>
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<tr>
<td></td>
<td>Patient and medical personnel are recommend to avoid speaking during slit lamp microscope isolation procedures</td>
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<tr>
<td></td>
<td>Ocular surface contact and invasive inspection should be avoided where possible</td>
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</tr>
<tr>
<td></td>
<td>Disinfection of contact inspection equipment before use (instruments should be dry and the disinfectant removed from instrument using normal saline before use) and non contact instruments</td>
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<tr>
<td></td>
<td>Elective ophthalmic surgery NOT performed in endemic regions when possible, and patients tested for infection before ophthalmic surgery ( 2 negative results at least 1 day intervals considered negative)</td>
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<tr>
<td></td>
<td>Ophthalmic surgery performed in a negative pressure or infected operating room for suspect and confirmed cases of COVID-19; airborne contact precautions during surgery, with operation room laminar flow turned off</td>
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<tr>
<td></td>
<td>Used medical instruments placed in a specially marked medical waste bags</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Virus infection checked after emergency ophthalmic surgery ( 2 negative results at least 1 day intervals considered negative) and symptoms monitored for 14 days after operative procedure</td>
<td></td>
</tr>
</tbody>
</table>

Lai, Tang, Chau, Fung, & Li., 2020(60)

Stepping up infection control measures in **ophthalmology** during the novel coronavirus outbreak: an experience from Honk Kong

Based on enhanced infection control measures adopted in an ophthalmology clinic in Honk Kong

- Reducing the number of daily patient visits, and suspension of non-urgent elective clinical services (e.g. elective cataract operations, electrodiagnostic studies, and contact lens clinics etc.)
- All personnel within the hospital were requested to wear facemasks, signage for respiratory etiquette, patients and visitors screened with an infra-red thermometer, fever patients were asked to reschedule their appointments/non-urgent procedure
- Patients with urgent admissions were attended in isolation rooms
- Patient screening questions to identify epidemiological links with COVID-19 cases and epidemic regions, patient triage
| Dental Care Procedures and Settings | Meng, Hua, & Bian., 2020(61) | Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine  
Authors provide experience-based guidance on COVID-19 nosocomial infection transmission in dental settings in China  
- Reduction of aerosol and droplet generating procedures  
- Installation of droplet protective shields between patient and clinician on slit lamps  
- IPAC training for staff on appropriate use of personal protective equipment  
- HH and disinfection of surfaces are strongly recommended due to the prevalence of aerosol and droplet generating dental procedures  
- Pre-check screening to establish risk of COVID-19 infection and triage to appropriate hospitals are recommended  
- PPE masks, goggles, gloves, gowns, face shields, N95 are being recommend for dental procedures  
- Routine dental practices suspended until further notice  
- Some dental consultations are being provided online, dental college classes also being offered on-line where possible  
- Only emergency procedures are taking place at the reporting site (No nosocomial transmissions among healthcare workers have been established as a result of emergency procedures)  
- Patient screening based on fever and clinical symptoms  
- Use of PPE based on identified patient risks  
- Minimize or avoid oral procedures (including oral surgeries) that can result in cough and pharyngeal reflexes/ produce droplets and aerosols  
- Mouthwash (povidone iodine (1%), cetylpyridinium chloride (0.05% ~ 0.10%) or mouthwash containing essential oil ingredients) are recommended to reduce aerosols generated by oral operations  
- Povidone iodine (1%) gargling has proven efficacy in reducing MERSA and SARS viral activity  
- Specific strategies for oral emergencies (i.e. tooth pain, dental trauma, temporomandibular joint dislocation, oral and maxillofacial trauma, and infection) are provided.  
- Disinfection process for dental and oral care settings such as, UV radiation, wet mopping and wipe-down of environmental surfaces | Li & Meng., 2020(62) | The prevention and control of a new coronavirus infection in department of stomatology (dental care settings)  
- Use of PPE based on identified patient risks  
- Minimize or avoid oral procedures (including oral surgeries) that can result in cough and pharyngeal reflexes/ produce droplets and aerosols  
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- Disinfection process for dental and oral care settings such as, UV radiation, wet mopping and wipe-down of environmental surfaces |
with chlorine-containing disinfectants, steam sterilization, chemical disinfectants, low temp. sterilization as appropriate. These are based on COVID guidance provided by Chinese National Health Committee.

- Reusable devices, appliances and articles used in patients with suspected or confirmed COVID-19 are to be immediately sterilized in 1 000 mg / L chlorine-containing disinfectant for 30 minutes, AND placed in double-layer instruments bag, hermetically sealed, and marked ""Special Infectious Device "" and supply reprocessing centers notified.
- Medical waste of suspected of confirmed COVID-19 cases should be placed in double-layer anti-leakage medical waste bags and marked as "Special infection"
- HH and PPE and respiratory etiquette are highlighted

<table>
<thead>
<tr>
<th>Haematology Settings and Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willan, King, Hayes, Collins, &amp; Peniket, 2020 (63)</td>
</tr>
<tr>
<td><strong>Care of haematology patients in a COVID-19 epidemic</strong></td>
</tr>
<tr>
<td>Commentary not official guidance</td>
</tr>
<tr>
<td>UK based</td>
</tr>
<tr>
<td>- Communication and remote working by collecting and confirming contact details of all patients</td>
</tr>
<tr>
<td>- Patient appointments transitioned to outpatient visits/online consultations where possible, asking patients waiting for inpatient appointments to wait in the car</td>
</tr>
<tr>
<td>- Consider outside phlebotomy clinics in car parked line ups, drive through drug dispensing</td>
</tr>
<tr>
<td>- Supportive care treatment to minimize long-term side effects and various transplant procedures be paused (after national agreement of what therapies are paused)</td>
</tr>
<tr>
<td>- Maintenance of non-curative chemotherapy be balanced with benefits if tight disease control, and oral therapy used where possible</td>
</tr>
<tr>
<td>- In dire situation of high community infection rates only life saving chemotherapies may be considered</td>
</tr>
<tr>
<td>- Discourage patient visits from friends and relatives</td>
</tr>
</tbody>
</table>

| Histopathology Laboratory Procedures and Settings |
| Henwood., 2020 (64) | Coronavirus disinfection in **histopathology**  
Commentary focusing on IPAC in histopathology laboratories, for Healthcare workers who collect, handle, or transport clinical specimens during COVID-19 epidemic | - Healthcare workers should adhere rigorously to the standard precaution measures and biosafety practices  
- Appropriate use of PPE based on specimen type and suspected organism, training of safe handling practices, clear labeling practices  
- Refers to laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Coronavirus Disease 2019 (COVID-19) published by CDC  
- Recommends the consideration of formalin-fixed paraffin-embedded tissue block technique for tissue fixation, to reduce risk of coronavirus infectivity; refrain from performing frozen sections on samples from possible cases of 2019-nCoV |
|-------------------|-------------------------------------------------|--------------------------------------------------|
| **Square Cabin Hospitals** | **Guidance for health protection in **square cabin hospitals** during the epidemic of new coronavirus pneumonia**  
Outlines health protection requirements for patients with mild infection symptoms who can be housed in square cabin hospitals (i.e. outdoor stadiums) | **Key guidance for square cabin hospital settings**  
- Design functional partitions for polluted (i.e. wards, treatment rooms, dirt rooms, hospital admission/discharge rooms), semi-polluted and clean areas (dressing room, catering room, duty room, warehouse) and two lanes for polluted and clean supply and equipment transport  
- Signage and barriers to identify separate areas (polluted vs. clean vs. semi-polluted) and outside of the makeshift to identify it as a square cabin hospital  
- Separate drinking water supply areas for each ward  
- Polluted and semi-polluted areas use natural ventilation or mechanical ventilation with air purification and disinfection mechanisms  
- Ventilation pipes attached to drainage pipes to be equipped with high efficiency filters  
- Sewage and waste water centrally disinfected  
- Disinfection of surfaces with chlorine concentration of 500mg/L disinfectant.  
- Temporary toilet arrangement and disinfection guidelines provided  
- Appropriate PPE for staff |
<p>| <strong>Zhang &amp; Li 2020(65)</strong> | | All settings including patient homes and healthcare settings |</p>
<table>
<thead>
<tr>
<th>Wang et al., 2020(66)</th>
<th>Guidance on the disinfection of patient homes and health care settings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Based on information published in the Program for Disinfection Technology in Special Places</td>
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</tbody>
</table>

**Hospital setting**
- Use disposable equipment and supplies when possible
- For non-disposable medical supplies, pressure steam sterilization is preferred, while chemical disinfectants or low-temperature sterilization are preferred for non-heat resistant items.
- Chlorine-containing disinfectants, chlorine dioxide, and other disinfectants are recommended for environmental surfaces.
- Iodophor, chlorine-containing disinfectants and hydrogen peroxide disinfectants, or quick-drying hand disinfectants are recommended for hand and skin.
- Peroxyacetic acid, chlorine dioxide, hydrogen peroxide sprays are recommended for indoor air disinfection.
- Soiled linens disinfected with circulating vapor, or boiling for 30 min, soaking with 500 mg/L chlorine-containing disinfectant for 30 min, prior to washing
- Spray disinfectants should only be used in well-ventilated areas, where people are not present, following the removal of contaminant.
REFERENCES


Appendix 1: Disinfection methods for commonly contaminated objects, outlined in *Program for Disinfection Technology in Special Places*

<table>
<thead>
<tr>
<th>Object</th>
<th>Disinfection method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor air</td>
<td>Peroxyacetic acid, chlorine dioxide, hydrogen peroxide, etc. ultra-low volume spray</td>
</tr>
<tr>
<td>Contaminants (blood, secretions, etc. from patient)</td>
<td>Water absorbent material carrying disinfectant (5,000–10,000 mg/L chlorine-containing disinfectant) for 30 min, or disinfectant dry wipes achieving high level of disinfection</td>
</tr>
<tr>
<td>Container for contaminants</td>
<td>Soaking with 5,000 mg/L chlorine-containing disinfectant for 30 min and then cleaning</td>
</tr>
<tr>
<td>Feces and sewage</td>
<td>Separate septic tank: adding chlorine-containing disinfectant and 10 mg/L the total residual chlorine after 1.5 h. Excreta in container: soaking with 20,000 mg/L chlorine-containing disinfectant for 2 hours when the ratio of fecal to disinfectant is 1:2. Massive dilution of excreta in container: disinfecting with 70%–80% dry bleaching powder for 2 h when the ratio of fecal to disinfectant is 20:1</td>
</tr>
<tr>
<td>Ground wall</td>
<td>Wiping and spraying with 1,000 mg/L chlorine-containing disinfectant or 500 mg/L Chlorine dioxide disinfectant for no less than 30 min, the range of spray volume from 100 mL/m² to 300 mL/m²</td>
</tr>
<tr>
<td>Surface of objects</td>
<td>Spraying, wiping, or soaking with 1,000 mg/L chlorine-containing disinfectant or 500 mg/L chlorine dioxide disinfectant for 30 min and then wiping with clean water</td>
</tr>
<tr>
<td>Clothing, bedding and other textiles</td>
<td>Circulating vapor or boiling for 30 min, soaking with 500 mg/L chlorine-containing disinfectant for 30 min, and then washing</td>
</tr>
<tr>
<td>Hand</td>
<td>Rubbing with quick-drying hand disinfectants containing alcohol or alcohol compound (first choice), wiping with 75% ethanol, rubbing with quaternary ammonium salt hand disinfectant, or soaking or wiping hands with 0.05% chlorine-containing or 3% hydrogen peroxide hand disinfectant, or wiping with 0.5% polyvidone iodine</td>
</tr>
<tr>
<td>Skin</td>
<td>Wiping with 0.5% polyvidone iodine or 3% hydrogen peroxide disinfectant for 3–5 min</td>
</tr>
<tr>
<td>Mucous membrane</td>
<td>Flushing saline or 0.05% polyvidone iodine</td>
</tr>
<tr>
<td>Tableware</td>
<td>Soaking with 500 mg/L chlorine-containing disinfectant for 30 min 500 mg/L or boiling</td>
</tr>
<tr>
<td>Transported and transferred tools</td>
<td>Spraying with 1,000 mg/L chlorine-containing disinfectant or 500 mg/L chlorine dioxide disinfectant for 30 min and then wiping with clean water</td>
</tr>
<tr>
<td>Domestic waste of patients</td>
<td>Treating as medical wastes</td>
</tr>
<tr>
<td>Medical wastes</td>
<td>Treating as medical wastes</td>
</tr>
<tr>
<td>Corpse</td>
<td>Filling the wound with 3,000–5,000 mg/L chlorine-containing disinfectant or cotton ball or gauze soaked with 0.5% peroxyacetic acid, wrapping the corpse with double sheet soaked the disinfectant, and then putting it in the double corpse bags</td>
</tr>
</tbody>
</table>